ANNOTATIONES ZOOLOGICAE JAPONENSES
Volume 36, No. 2—June 1963

Published by the Zoological Society of Japan
Zoological Institute, Tokyo University

Phagocata tenella, a New Freshwater Planarian, from Hokkaidô[1]

With 3 Text-figures

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(*Communicated by* K. Takewaki)

A good number of white planarians were collected by the junior author in the summer of 1958 from hill streams in the vicinity of Mt. Apoi and in the Horoman River system, Hidaka, in southern Hokkaidô. On investigation, the writers have reached the conclusion that this planarian is a new species in the Japanese fauna. Further, judging from the circumstances of their habitats and from their very small eyes, the species herein described is probably subterranean form.

Information concerning fixation and staining have been presented in previous articles on planarians (cf. Ichikawa and Kawakatsu, 1961 and 1963). Some serial sections were stained with Mallory's triple stain.

Order Tricladida
Suborder Paludicola or Proborsalia
Family Planariidae
Genus *Phagocata* Leidy, 1847
Phagocata tenella, new species

Description. This is a rather small and very slender species. Sexually mature specimens are usually 10 to 12 mm long and 0.7 to 1 mm wide. In quietly gliding animals, the anterior end is truncated or is slightly lobed with a convex frontal margin. At the lateral corners of the head there is a pair of short, bluntly pointed tentacles. Behind the head, the body first narrows slightly, then gradually widens and reaches its greatest width at the levels of the pharynx and the copulatory apparatus. From there the body tapers to a rather pointed posterior end (Fig. 1A).

The body lacks pigment and usually appears white and somewhat translucent. The areas occupied by the pharynx and the copulatory apparatus are opaque milk-white.

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[1] Contribution No. 588 from the Zoological Institute, Faculty of Science, Hokkaido University, Sapporo, Japan.

Typically, there are two very small eyes, situated close together and farther removed from the frontal margin than from the lateral margins. But in many specimens examined it is observed that the size and the arrangement of the two eyes are not symmetrical (Fig. 1 B and C). Several specimens show supernumerary eyes. Figure 1 (D) is a sketch of one of these specimens.

The pharynx appears somewhat long for the size of the animal. It is situated, in sexually mature specimens, somewhat behind the middle of the body and measures one-fifth to one-fourth the total length of the animal. The pharynx of the species is structurally typical of the genus *Phagocata* and of the family Planariidae. In mature worms the anterior intestinal trunk bears 16 to 18 branches on each side. Each posterior trunk has 6 to 8 short lateral branches. The genital pore is at or a little behind the middle of the postpharyngeal region.

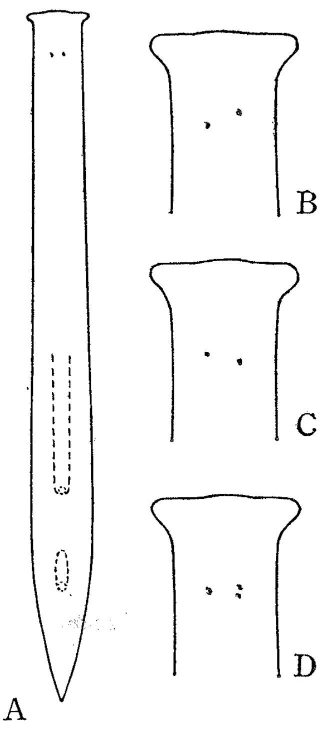

Fig. 1. *Phagocata tenella*, new species. **A**: sketch of living specimen. Actual length, 10 mm. **B**, **C** and **D**: enlarged sketches of the head region and the eye variants.

In histological sections the marginal adhesive zone is mainly seen below the anterior and posterior margins of the body. In the present form, however, the ventral anterior head margin does not present any caved-in epithelium as seen in *Phagocata albata* Ichikawa et Kawakatsu, another Japanese unpigmented subterranean planarian of the same genus.

The five available fully grown specimens were sectioned. The ovaries, a pair of rounded compact masses, occur in the usual anterior position, lying between the second and third intestinal diverticula (Fig. 2A). The ovovitelline ducts (or oviduct) at their posterior ends unite to a short common ovovitelline duct. Numerous yolk glands occur throughout the body between the intestinal diverticula.

The testes are numerous and are arranged, on each side of the median line, in a longitudinal zone extending from the level of ovaries to the level of the copulatory apparatus. They occupy almost the entire dorso-ventral diameter of the parenchyma of the body (Fig. 2B). The sperm ducts are distended into the well-developed spermiducal vesicles packed with spermatozoa as they proceed posteriorly along each side of the pharynx (Fig. 2C).

A sagittal view of the copulatory apparatus, constructed from three sets of sagittal sections, is shown in Figure 3.

The penis bulb is a small and slightly developed muscular organ embedded in the parenchyma. The sperm ducts, ascending from below into the penis bulb, enter the bulbar cavity (or seminal vesicle) separately. It is a narrow tubular cavity and continues through the penis papilla as the ejaculatory duct (Fig,

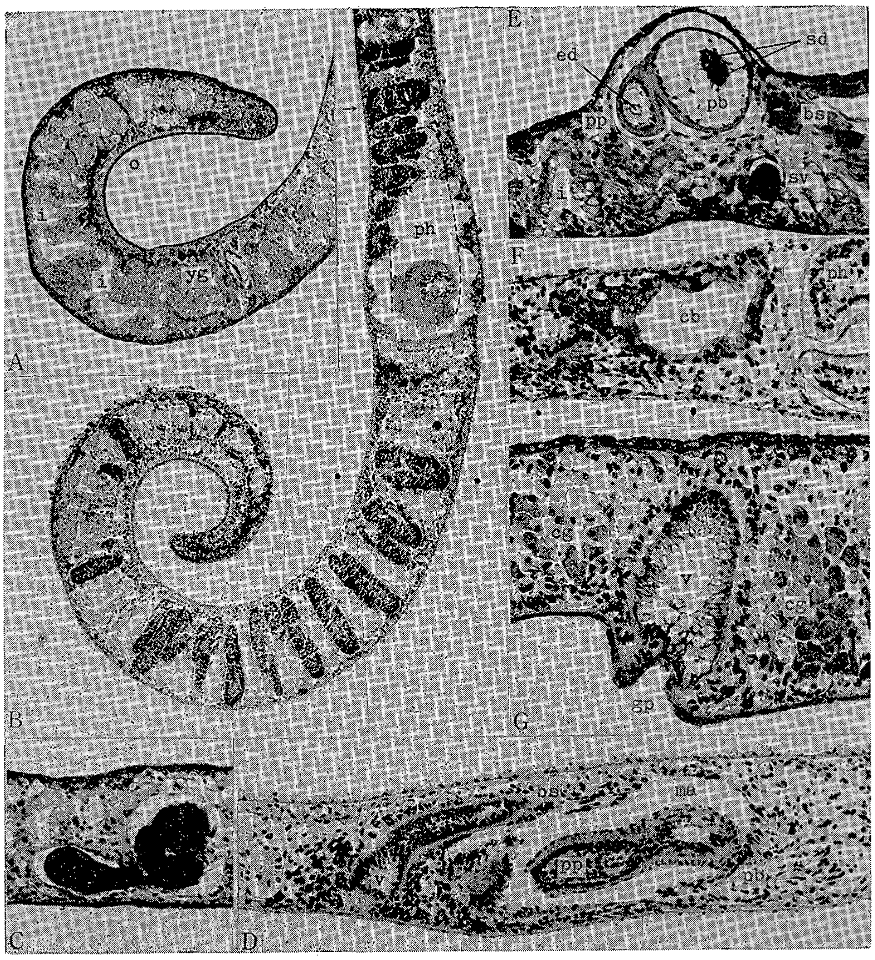

Fig. 2. Reproductive system. **A**: sagittal section of the prepharyngeal region, showing the situations of ovary, yolk glands and intestine (No. 271 a). **B**: sagittal section of the region anterior to the level of the copulatory apparatus, showing the situation of testes (No. 271 c). The broken line shows the outline of pharynx of this specimen. The arrow indicates the position of mouth opening. **C**: sagittal section of the pharyngeal region, showing a part of spermiducal vesicle (No. 271 a). **D**: sagittal section of the copulatory apparatus (No. 271 c). **E**: sagittal section through the penis (No. 271 a). In the slide the penis is strongly curved. Notice the sperm ducts and the ejaculatory duct. **F**: sagittal section of the copulatory bursa (No. 271 b). **G**: sagittal section showing the distal part of the bursal canal, enlarged (No. 271 a). Notice the granular secretions of the cement glands which in the preparation appear feebly stained with eosin. bs: bursa stalk; cb: copulatory bursa; cg: cement gland; ed: ejaculatory duct; gp: genital pore; i: intestine; ma: male antrum; o: ovary; pb: penis bulb; ph: pharynx; pp: penis papilla; sd: sperm duct; sv: spermiducal vesicle; v: vagina; yg: yolk gland.

2 D and E). The bulb is pierced by numerous gland ducts. The penis papilla has a very long finger-shaped form; it projects into a well-developed male antrum that narrows towards the genital pore. The outer walls of the papilla and the male antrum are covered with a cubical epithelium. But the roof of the

posterior part of the antrum is lined with a tall, highly glandular covering epithelium (Fig. 2 D). The posterior part of the male antrum receives the common ovovitelline duct into its dorsal wall. The cement glands are found around the common ovovitelline duct and the genital pore (Fig. 2 G).

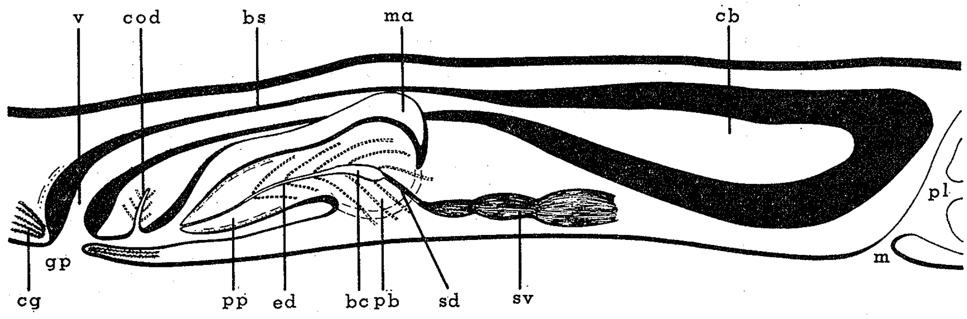

Fig. 3. Diagram showing the sagittal view of the copulatory apparatus. bc: bulbar cavity; bs: bursa stalk; cb: copulatory bursa; cg: cement gland; cod: common ovovitelline duct; ed: ejaculatory duct; gp: genital pore; m: mouth; ma: male antrum; pb: penis bulb; pl: pharynx lumen; pp: penis papilla; sd: sperm duct; sv: spermiducal vesicle; v: vagina.

The copulatory bursa is moderate or large in size and is situated anterior to the penis bulb, between it and the posterior end of the pharyngeal chamber. It is elongated oval in shape with somewhat irregularly lobed outline (Fig. 2 F). The bursa stalk is a narrow duct which runs posteriorly and curves ventrally to reach the genital pore. The terminal part of the bursal canal or the vagina is expanded and lined by a very tall epithelium (Fig. 2 G). The entire female copulatory apparatus is slightly musculated. In the specimens of the present material at hand, there is, in fact, no development of a common antrum as the vagina joins the male antrum almost at the genital aperture.

The cocoon of this species is not known.

Remarks on Taxonomy and Differential Diagnosis. Taxonomic and chorological discussion concerning the known species of the genus *Phagocata* reported from the north-eastern part of the Far East and the North Pacific areas has been presented in the writers' previous articles on freshwater planarians (Ichikawa and Kawakatsu, 1962 a, b and c). The unpigmented species among these *Phagocata* species are: *Phagocata albata* Ichikawa et Kawakatsu (1962 a) and *Phagocata* sp. of Tsushima Islands (Ichikawa and Kawakatsu, 1962 c) from Japan; *Phagocata*? *pellucida* (Ijima et Kaburaki, 1916) from South Sakhalin; *Phagocata coarctata* (Arndt, 1922) from the vicinity of Vladivostok, Primorsk, and *Phagocata*? sp. of Lake Baikal (Basikalova, 1947, olim *Penecurva*?) from Siberia; *Phagocata nivea* Kenk (1953) from Alaska. Amongst these six species, *Phagocata albata*, *Phagocata coarctata* and *Phagocata nivea* are indubitable ones.

Phagocata albata, *Phagocata nivea* and *Phagocata* sp. of Tsushima Islands differ from the present form externally in having a different contour of the head. Judging from Arndt's sketches of *Phagocata coarctata* (cf. 1922, p. 100, Text-fig. 1, Taf. IV, Fig. 1) and from Ijima and Kaburaki's sketch of *Phagocata*?

pellucida[2] (cf. 1916, p. 165, Fig. 18), the external appearance of *Phagocata tenella* is somewhat similar to that of the former two species. However, figures of the copulatory apparatus of *Phagocata coarctata* (cf. Arndt 1922, Taf. IV, Figs. 8, 9, 10, 11 and 12) show a short penis papilla, a copulatory bursa of small size with a bursal canal of nearly uniform diameter and the presence of a common genital antrum.

The four unpigmented *Phagocata* species, two cave inhabitants and two spring dwellers, are known from North America. The first species, *Phagocata subterranea* Hyman (1937), from Indiana caves, is polypharyngeal planarian. The second one, *Phagocata cavernicola* Hyman (1954), from Pennsylvania caves, is slightly similar to *Phagocata tenella* in arrangement of testes and anatomical structure of the female copulatory apparatus (cf. Hyman, 1954, pp. 563–566 and Fig. 65 a–c). The third and the fourth species are *Phagocata morgani* (Stevens et Boring, 1906) and *Phagocata morgani polycelis* (Kenk, 1935). However, the Japanese form differs from these three Neoarctic planarians, *Phagocata cavernicola*, *Phagocata morgani* and *Phagocata morgani polycelis*, mainly in general appearance and in the structure of the male copulatory apparatus.

Phagocata tenella differs from the other members of the genus in the following characters: living animals rather small, very slender and white; head truncated with blunt projecting tentacles; having two small eyes (irregularities may occur); testes numerous, extending to the level of the copulatory apparatus; penis bulb small and weak muscular with narrow bulbar cavity into which sperm ducts enter separately; penis papilla finger-shaped, long and pointed; common ovovitelline duct short and entering roof of the posterior part of the male antrum; copulatory bursa large and elongated oval shaped; vagina opens into the genital pore and common antrum non-existent.

Holotype. One set of sagittal serial sections (Specimen No. 271 c, 5 slides) deposited in Professor Ichikawa's room of the Zoological Institute, Faculty of Science, Hokkaido University; also 4 sets of sections (No. 271 a, b, d and e).

Locality. Collected by M. Kawakatsu in pools of swampy land in the vicinity of Mt. Apoi and in spring-fed brooklets and pools along the road between Horoman and Onarushibe (Horoman River system), Hidaka, southern Hokkaidô.

Ecology. In the Hidaka district, *Phagocata tenella* was found in stations below an altitude of about 580 metres (Aug. 19—21, 1958: 12.1—20.9°C, pH 6.0—6.4). *Polycelis sapporo* (Ijima et Kaburaki), *Polycelis akkeshi* Ichikawa et Kawakatsu, *Polycelis auriculata* Ijima et Kaburaki and *Dendrocoelopsis lacteus* Ichikawa et Okugawa also occurred from some of these stations.

The first survey trip of the district was made in 1958 immediately after a heavy rain. *Phagocata tenella* was taken under fallen leaves and stones in many temporary pools near springs. Recently, the writers made two visits to the district, but did not find any freshwater habitats except for several mountain streams that contain only other planarians.

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[2] This species was described from immature specimens collected from the vicinity of Vladimirofka, South Sakhalin (cf. Ijima and Kaburaki 1916, pp. 165–166; Kaburaki 1922, pp. 31–32). Arndt (1924a, pp. 245–247) expressed his opinion that *Planaria coarctata* is the same as this species. Several taxonomists expressed the same or somewhat similar views (cf. Kato 1943, p. 629; Livanow and Zabusova 1940, pp. 153–154; Okugawa 1953, p. 38; Tu 1940, p. 217). The taxonomy of *Phagocata? pellucida* and *Phagocata coarctata* was also discussed by Kenk (1953, p. 167).

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